

Sending End and the Receiving End Surges When A Phase -A Switched with Unit Step Voltage

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ABSTRACT

We are basically discussing the following part of work for surges using Fuzzy logic transformation. We can calculate the surges in the form of Fuzzy elements.

Keywords: V_{AR} surges, V_{CR} surges.

INTRODUCTION

In the field most often a phase- A is switched for the study of the surges in other two phase-B and C as represented in Fig. 3.1 S and r are the symbols used for sending and receiving.

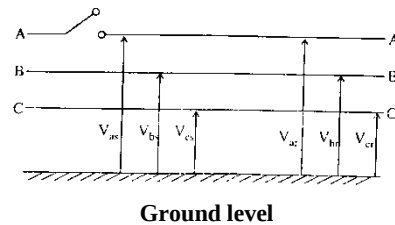


Fig. 1 Study of the surges in other two phase-A, B and C

End voltages of surges. Mostly the receiving end voltages are important due to the strike with the surges arrester and transformer we will study one by one the six surges V_{AR} , V_{BR} and V_{CR} at the receiving end.

We will also study the sending end surges. V_{AR} , V_{BS} and V_{CS} for their mutual coupling and interference with the other devices.

1. STUDY OF RECEIVING END VOLTAGE V_{AR}

We develop a model to calculate the time in micro seconds of the surge and the membership functions of Fuzzy. We call them Fuzzy grade of truth of Fuzzy membership functions. We call them X variable for the time variation.

Table – 1

X	12	24	40	80	120	154	160	170	240	260	320
$\mu(x)$	0.2	0.3	0.4	0.5	0.54	0.60	0.65	0.72	0.78	0.8	0.85

We encounter the element X and its element hood $\mu(x)$. The mathematical nature of the fuzzy logic would be known using by fuzzy cardinality, fuzziness and other related parameters of fuzzy sets. Relative fuzzy cardinality would be the reliability is failure rate will be found.

The fuzzy cardinality would be

$$[A] = \sum_{x=1}^{12} \mu(x) = 5.55 \quad (1)$$

The relative fuzzy cardinality will be

$$||A|| = \frac{|A|}{x} = \frac{|A|}{12} = \frac{5.5}{12} = 0.46 \quad (2)$$

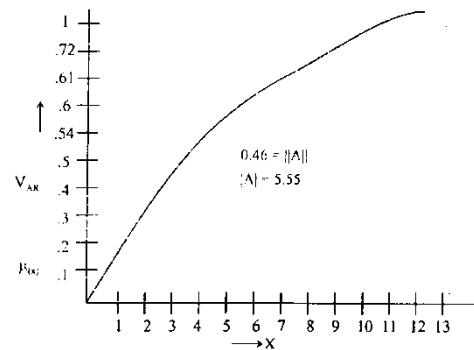


Fig. 2 Voltage Search V_{AR} with x and $\mu(x)$

Reliability of the system would be 0.46

Table -2

X	8	10	36	44	74	120	100	160	170	180	240	260
$\mu(x)$	.1	.15	.2	.212	.2	.18	.10	.02	0	.2	.51	.10
	1	2	3	4	5	6	7	8	9	10	11	12

2. STUDY OF V_{BR} SURGE -

The V_{BR} voltage surge at the receiving end is negative up to $160_{\mu s}$. We investigate the surges as follows in table 3.2

negative numbers are subtracted from positive surges to get resultant voltage.

The Fuzzy cardinality would be:

$$|A| = \int_0^{12} \mu(x) dx = 1.972 \quad (3)$$

and

$$||\bar{A}|| = \frac{1}{x} \int_0^x \mu(x) dx = \frac{1.972}{12} = 0.16433 \quad (4)$$

The reliability of the system is very low as much as 0.16433. These results are approximated by mathematical solutions on $\text{erfc}(x)$. These surges are not comparable with the V_{AR} as being negative direction. Even Fuzzy logic is not applicable. The results are highly random and fuzzy.

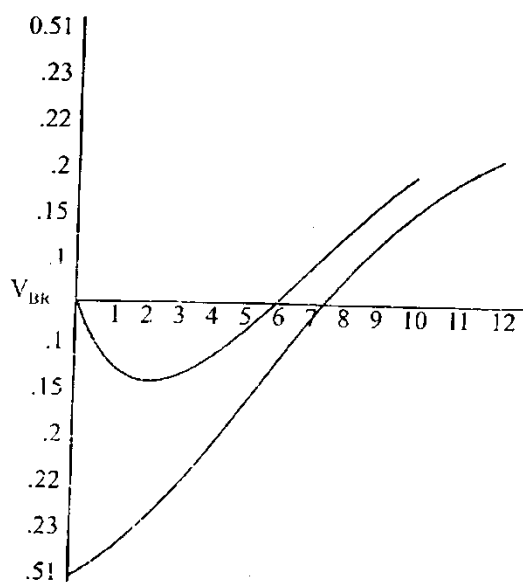


Fig. 3 V_{BR} Surges Simulation

3. STUDY OF V_{CR} SURGE –

The voltage of phase -C at the receiving end voltage is reduced due to voltage drop due to mutual coupling and line resistance. We fuzzify the surge by the membership functions $\mu(x)$ as follows in table - 3.

Table -3

X	4	12	20	40	80	100	120	160	100
$\mu(x)$	.12	.17	.22	.23	.24	.2	.17	.11	.07

Similar method is used to find the reliability of a surge arrester. The fuzzy cardinality would be

$$|\bar{A}| = \int_0^0 \mu(x) dx = 1.29 \quad (5)$$

The relative fuzzy cardinality will be

$$||\bar{A}|| = \frac{1}{x} \int_0^9 \mu(x) dx = 0.1433 \quad (6)$$

This may be the reliability of the system under the surge. The surges V_{BR} and V_{CR} create large number of complications being negative. The reliability of 0.1433 confirms that study may be true.

The three waves are highly random and quit uncertain. The CRO graphs are brought to the study to predict the shapes of the waves one can

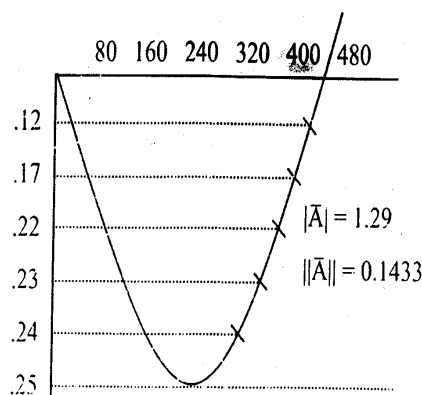


Fig. 3-1 V_{BR} Surges Simulation

Fuzzy them using simple method of fuzzification and fuzzy sets are assumed. The mean moment method [MOM] is used to find the results.

All these studies are taken from the literature of Chhalotra's Ph. D. thesis in 1974 where the subject has pending for fuzzy logic theory.

The results are the simply simulation studies tending to know the shapes of the surges. The reliability is assumed to be approximately to be fuzzy grades.

4. STUDY OF SENDING END VOLTAGE V_{AS} SURGE

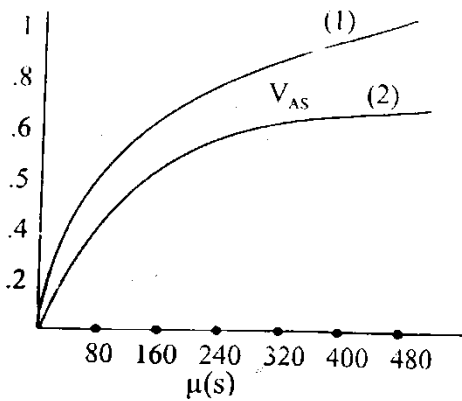


Fig. 4-1 Voltage V_{AS} surge

X	12	24	40	80	100	160	240	320	400	480
$\mu(x)$	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5

The fuzzy cardinality would be

$$|\bar{A}| = \int \mu(x) dx = 4.4 \quad (7)$$

Relative fuzzy cardinality $\|\bar{A}\| = 0.44$

The reliability May be 0.44 %

5. PHASE -B SENDING END SURGE

V_{BS}

We may develop the x and $\mu(x)$ of the surge in table 3-5 as follows.

X	1402	80	90	100	160	180	240	380
$\mu(x)$	0.1	0.2	0.27	0.28	0.3	0.3	0.3	0.3

The fuzzy cardinality would be

$$|\bar{A}| = \int_0^8 \mu(x) dx = 2.05 \quad (8)$$

and

$$\|\bar{A}\| = \frac{1}{n} \int_0^n \mu(x) dx = 0.256 \quad (9)$$

The reliability would be = 25.6 %

The phase - B sending ends surge is called V_{BS} is represented in Fig. 3.5 This is a plot between microseconds and voltage surges. The surges are assumed as Fuzzy grades of truth with element x as calling them time. We call them x as fuzzy grades.

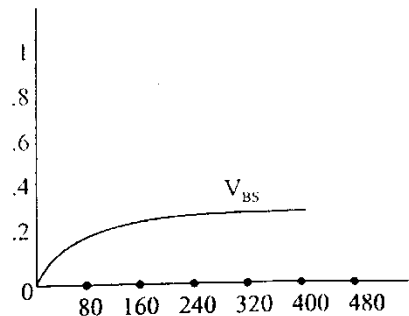


Fig. 5-1 Time $\mu(s)$ Microseconds.

$\mu(x)$ belong to the time of the surges we have taken the x as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 in the x plane. The fuzzy membership functions are included in the time space. The results are near to our expectations. When we calculate reliability using failure rates. The time will give us the failure rate λ .

The time space can be converted to the failure rate data and the reliability space may be found to match the random results. The fuzzy logic is used for highly random numbers of surges. The surges seem to be under our model of reliability and fuzzy cardinality.

6. PHASE - C SURGES AT SENDING END VOLTAGE V_{CS}

We can simulate a table-6 for the study of the surge V_{CS} as follows.

X	0	20	36	60	80	100	160	240	320
$\mu(x)$	0	0.1	0.2	0.3	0.35	0.38	0.4	0.4	0.4
n	1	2	3	4	5	6	7	8	9

One obtains the fuzzy cardinality as follows:

$$|\bar{A}| = \int_0^x \mu(x) dx = 2.53 \quad (10)$$

$$\|A\| = \frac{1}{x} \int_0^x \mu(x) dx = 0.2811 \quad (11)$$

The reliability of the system would be 28.11 % the failure rate data obtained from time scale are also of this great as 28.11 % one can consider the average time of surges and their fuzzy grades of truth.

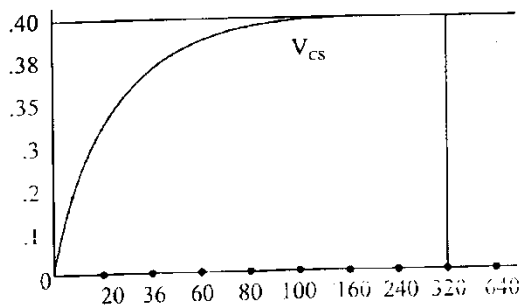


Fig. 6-1 Fuzzy Grades of Truth

$$X = 20, 36, 60, 80, 100 \quad (12)$$

$$\mu(x) = 0.2, 0.36, 0.6, 0.8, 1 \quad (13)$$

$$|\bar{A}| = 2.98$$

and

$$\|\bar{A}\| = 0.592 \quad (14)$$

The results seem to be optimistic in the inference of the fuzzy logic heuristic plane. Such decisions can be obtained using graph theory of break even analysis of the surges with their constraints.

DISCUSSION -

In this paper we will describe and calculate phase surges at the sending end and the receiving end terminals of three phase line ABC, when phase A is excited by unit step voltage $\mu(t)$. The nature of graph save calculated using fuzzy logic transformation as $\text{erfc}(x)$ nature. The graphs are also experimentally measured by CRO displays and digital compute. Analogue are also developed and measure. The mathematical modeling is simple and easy.

We name them as V_{AS} , V_{BS} , V_{CS} , and V_{AR} , V_{BR} , and V_{CR} at the sending end designated as S and receiving end designated as R. The graphs represent simulation for the study of surges using fuzzy logic. This is useful for those who study fuzzy logic and surges. This is a special subject for only scholars. The line surges should be known by the general people for electrical engineering. This can give shock hazards and accidents surges are present for a short time but give a big shock do can se death.

Phase A is switched for once we study the surges in other phase B and C because they can give shock hazards, surges

are always present in electronic instruments also when they are switched. Even CRO, diodes, triodes and amplifiers rectifiers can also give shock. Even a two volt battery can generate a surge of very high magnitude for microseconds.

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